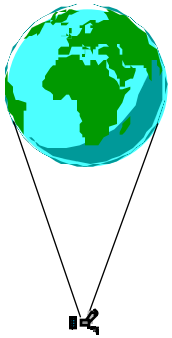

ULDB Demonstration Program: *Balloon*

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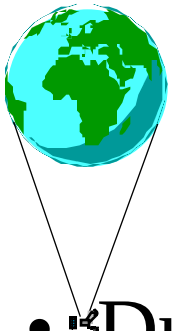
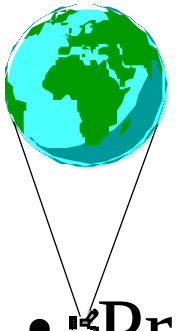


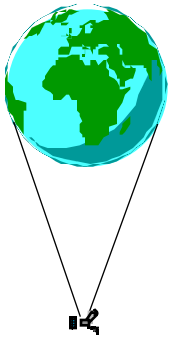
Balloon Design Requirements

- Duration up to 100 days
- Global flight capability
- Total suspended weight to 1600 kg
- Minimum float altitude of 33.5 km



ULDB Balloon Shape

- Proposed design - Pumpkin Shape
  - Volume 731,200 m^2
  - Number of gores 268
  - Gore width 1.5 m (maximum)
  - Inflated dimensions Height 78.6 m (height)
    128.2 m (diameter)
  - Surface area 40,800 m^2
  - Gore length 169 m
  - Weight 2,800 kg
- Above design based on worst case environments, a/e=0.3, and maximum material weight
- Material characterization to be completed



Spherical vs. Pumpkin Design

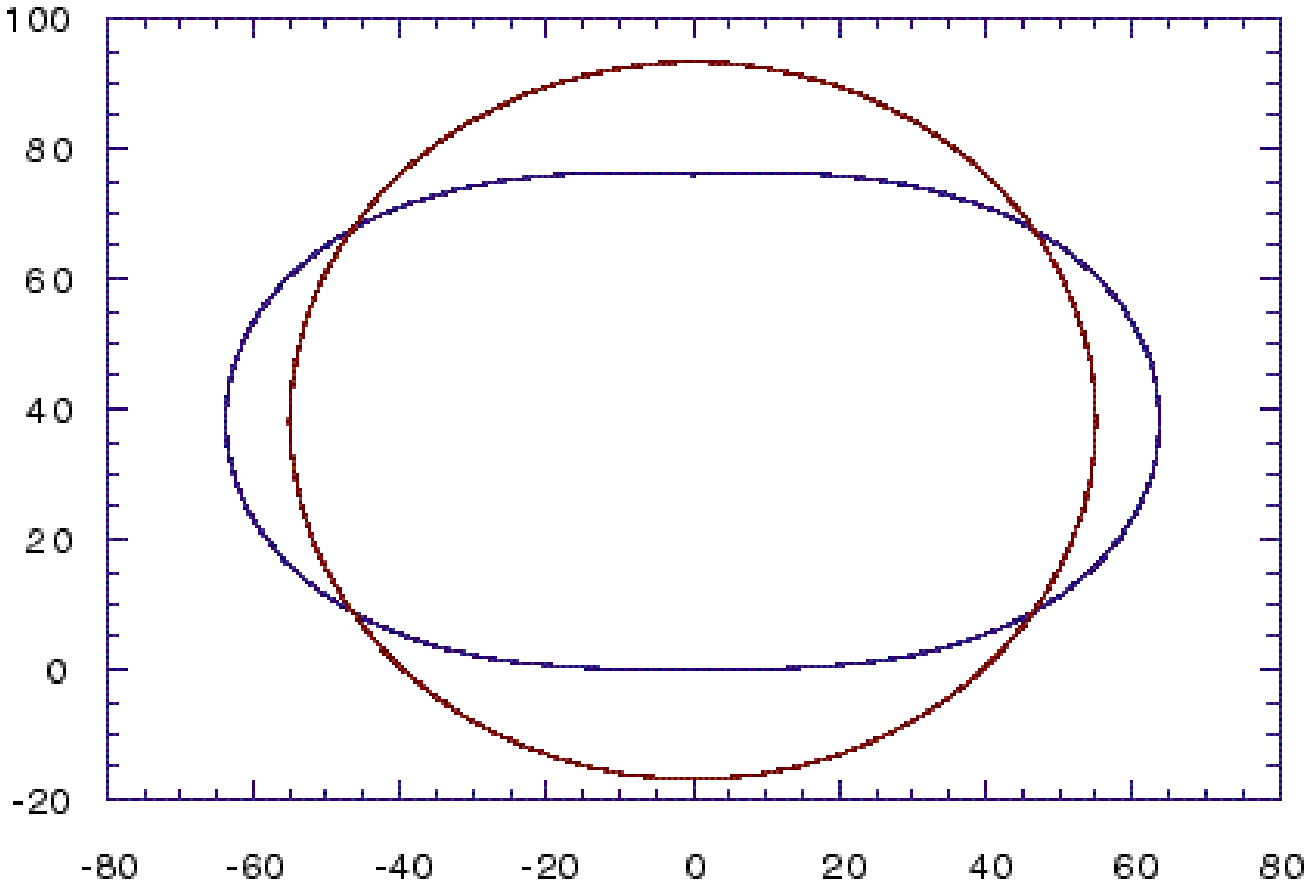
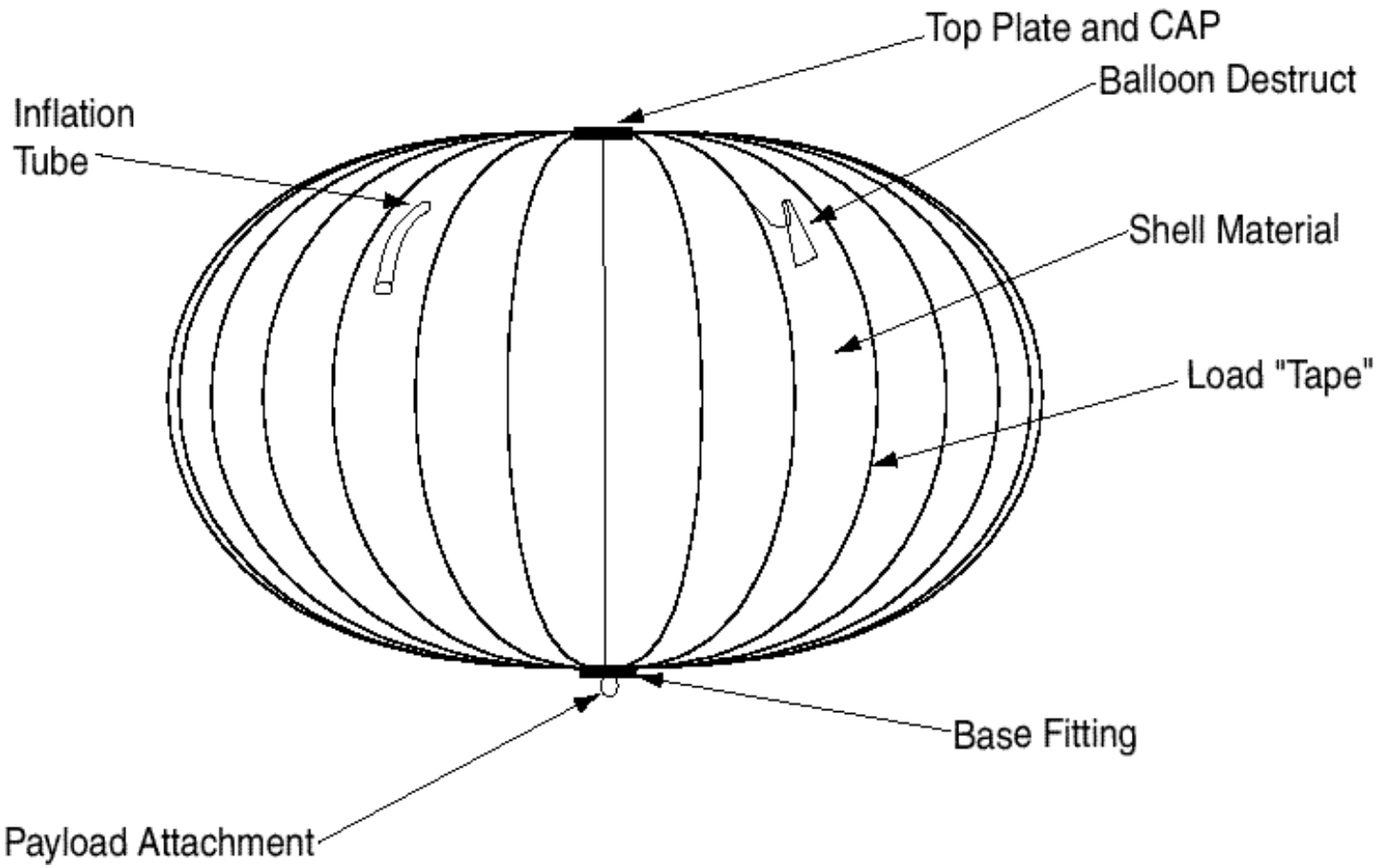
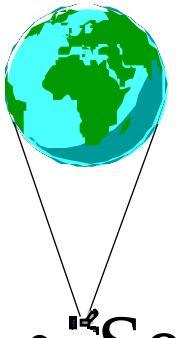


Fig.1- Pumpkin shape vs. volume equivalent sphere.

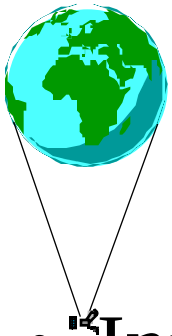
Balloon Schematic





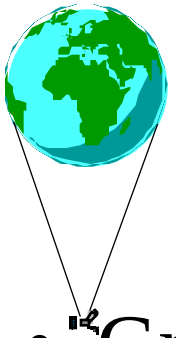
Balloon Seams, Load Members, and Fittings

- Seams will be bi-tape seams
  - Testing of existing seams has shown 100% of base material strength
  - Fabrication speed important
- Load member
  - Desire for very stiff tendon with high strength
  - Included in tape or as separate fiber bundle
  - Three candidate materials - Kevlar, PBO and Spectra (Dynema)
- Fittings
  - Plate with circular clamp ring
  - Wedged load line termination (baselined)
  - Load attachment similar to current design



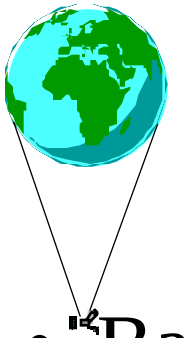
Balloon Inflation and Destruct

- Inflation
  - Very similar to current Zero-Pressure Balloons
  - He diffuser into inflation tube
- Destruct
  - Two independent methods
  - Valve on apex of balloon
  - Rip panel on balloon shell



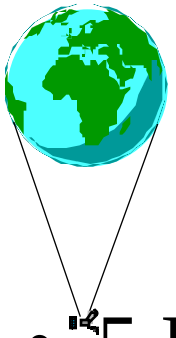
Performance

- Gross inflation limited to 5,000 kg
- Predicted day night variations
  - Assumes worst case environments
  - Night altitude 35,000 m Day altitude 35,300 m
  - Night superpressure 20 Pa Day superpressure 195 Pa
- Leakage
  - Measured leak rate of fabric and mylar film composite (with no polyethylene layer) predicts no requirement for use of ballast over 100 days



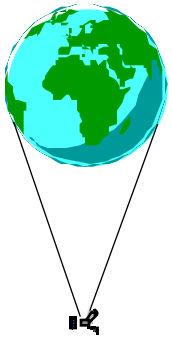
Vehicle Development Plan

- Balloon Design and Analysis at WFF
- Balloon Fabrication Under Contract
- Implementation of a 5 Phase Plan
- Ground Testing
- Flight Testing



Vehicle Development Contract

- 5 Phase Plan Establishes
  - Partners
  - Materials
  - Fabrication techniques
  - Production equipment
  - Procedures/QC
  - Mechanism for purchasing all flight balloons
- RFP issued 5/22/98
- Phase I award 7/6/98
- Phase II award 10/30/98

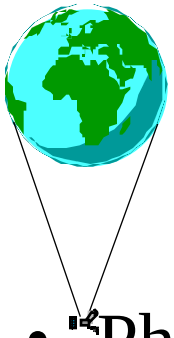


Vehicle Technology Partners

NASA
Leads the team
Project management
Defines the requirements
Materials development and specification
Overall mission specification
Analysis

PSL
Balloon mission and operations
Overall balloon design and specification

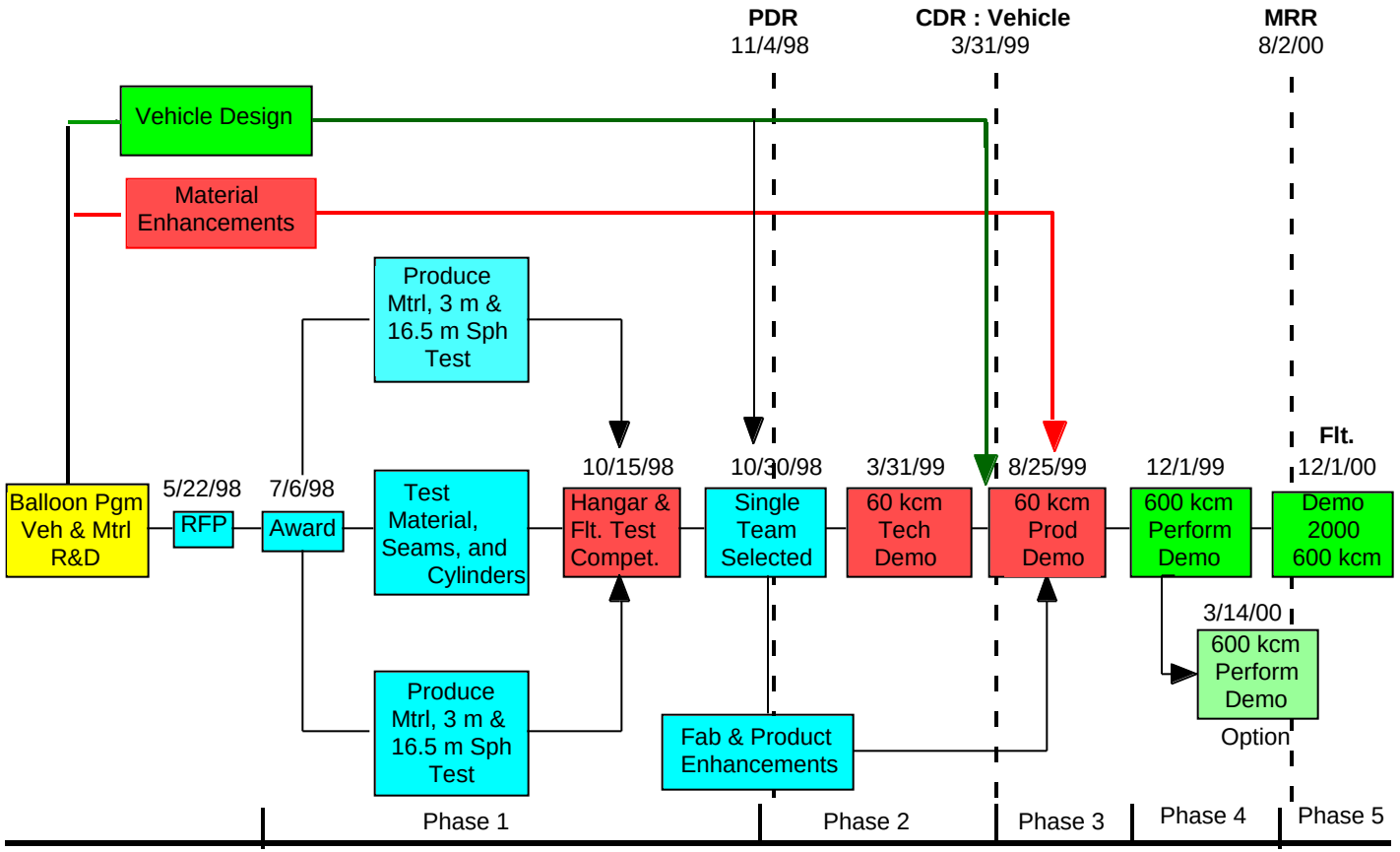
Fabricator Team
Detailed balloon design
Material production
Balloon fabrication
Process engineering and development
Process machinery design and development
Specification development

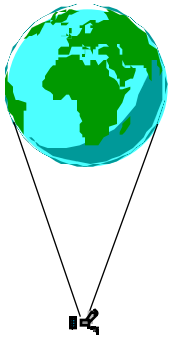


Phase Development Plan

- Phase I (Prototype Demonstration)
  - Selection of teaming partner
- Phase II (Technology Demonstration)
  - Teaming of NASA, PSL, and the Fabricator Team
  - Start of design and development of automated material and/or balloon fabrication machinery
  - Scale up of flight structure
- Phase III (Production Demonstration)
  - Automated material and/or balloon fabrication machinery
- Phase IV (Performance Demonstration)
  - Scale up of flight structure
  - Performance of material and balloon design for extended flight
- Phase V (Demo 2000)

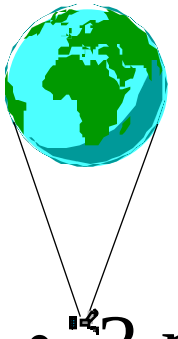
Technology and Vehicle Implementation





Test Flights, Balloons by Phase

Phase	Balloon Size	Prototype Testing Complete	Launch Location	Duration
Phase I (Prototype Construction)	3 m diameter spherical balloon	September 18, 1998	Wallops Island	Ground Test
	16.5 m diameter spherical balloon	October 15, 1998	Ft. Sumner	To Float Only
Phase II (Technology Demonstration)	3 m diameter pumpkin balloon	December 31, 1998	Wallops Island	Ground Test
	60,000 m3 volume (estimated)	March 1, 1999	Ft. Sumner	3 - 6 hours
Phase III (Production Demonstration)	60,000 m3 volume (estimated)	August 25, 1999	Lynn Lake, Canada	0.5 to 3 days
Phase IV (Performance Demonstration)	600,000 m3 volume (estimated)	January 31, 2000	Alice Springs, Australia	10 to 20 days
Phase V (Demo 2000)	600,000 m3 volume (estimated)	January 31, 2001	Christchurch, NZ	~100 days



Hangar & Flight Tests

- 3 m Diameter Hangar Balloon
  - Material Design
  - Seam Design
  - End Fitting Design
  - Fabrication Technology
  - Structural Integrity
  - Performance
- 16.5 m Diameter Flight Balloon
  - Used, in part, to determine structure strength, ability to get to float, and identify any flight concerns
  - Payload - radio sondes with an internal pressure gauge
  - Ascent to burst